



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

XXXII. *Observations on the genus Planaria.* By J. R. JOHNSON,
M. D. F. R. S.

Read June 27, 1822.

I BEG leave to lay before the Royal Society a few observations on the genus PLANARIA, to which I have been more immediately led, from two or three species having been already described in the Linnæan Transactions under the genus HIRUDO.

I shall confine my remarks in the present paper to the following species: *P. cornuta*, *P. torva*, *P. brunnea*, and *P. lactea*, intending to give, at some future period, the farther history of this singular and extensive genus.

P. cornuta.

Planaria depressa, oblonga, nigro-cinerea, antice tentaculis instructa.

Long. 4 *lin.* *Lat.* 2 *lin.*

Body, blackish brown, convex above, flat beneath; fore part exsertile and retractile, with a tentaculum or feeler projecting on each side of the head; tail pointed; two ventral foramina; numerous eyes.

P. torva.

Planaria depressa, oblonga, cinerea, subtus albida, iride alba.

Long. 6 lin. Lat. 2 lin.

Body, brown on the back ; grey or whitish on the belly ; slightly convex above, plain beneath ; truncate before, pointed behind ; iris, white ; two ventral foramina ; eyes, two, black, in a white areola.

P. brunnea.

Planaria oblonga brunnea, linea longitudinali nigra.

Long. 5 lin. Lat. 2½ lin.

Body, dark brown, with a black dorsal longitudinal line ; convex above, plain beneath ; obtuse before, slightly pointed behind ; two ventral foramina ; numerous eyes.

P. lactea.

Planaria depressa, oblonga, alba, antice truncata.

Long. 6 lin. Lat. 2½ lin.

Body, milky-white, or cream-colour ; slightly convex above, plain beneath ; truncate before, sharply pointed behind ; lateral margin acute, pellucid ; two ventral foramina ; eyes, two, deep black.

These little animals, which are delineated of their natural size, in Fig. 1, 2, 3, 4, are generally found in slow streams, assembled together in clusters, attached to the roots, or under surfaces of the leaves of aquatic plants, pieces of wood, stone, &c. In a state of rest, they are of a circular or spherical shape ; when in motion, linear. They are remarkably quick and rapid in their movements, and contract and lengthen themselves with the greatest facility. From their great con-

tractility, the body consisting of a series of annular muscles, they are enabled to assume almost every variety of figure. In traversing a smooth surface, they have usually a gliding or snail-like motion, leaving a viscous tract behind ; but when the surface is rugged, they quit this gliding motion, and move forward like the leech, alternately attaching the head and tail : they do not, however, as far as I can perceive, fix the tail ; they simply draw it up, when the body is firmly retained by the strong glutinous substance with which it is invested.

The *Planariæ* are often seen traversing the surface of the water in an inverted position, and with the same facility as the *Glossopora*, described in a former paper. When gliding along, they move the head from side to side with rapidity, but on coming suddenly into contact with any hard substance, they immediately retract, or draw in the fore-part of the body, somewhat like the *Limax*.

On visiting the rivulet, from which I was in the habit of taking these animals for the experiments I am about to relate, I was surprised to find a large body of them (*P. torvæ*) proceeding against the current, gliding over its sandy bottom, keeping the same order as ants when passing from one of their establishments into another, and occupying a space of about twelve inches in length by two in breadth. This regular movement I observed two or three days in succession. The weather being at this time extremely temperate, had, doubtless, induced them to quit their several hiding places ; but I could not discover the purport of this proceeding.

The *Planariæ* are so gelatinous and pulpy in their texture, as scarcely to allow of any very accurate dissection. I may

however remark, that the body consists of one common cavity, with diverging lateral cells or branches, destined to contain the nutriment; being in this arrangement very analogous to the stomach of the medicinal leech.

In the absence of food, the *interanea* of these animals cannot be distinctly seen. In the *P. lactea*, they present a beautifully arborescent appearance, as delineated, highly magnified, in fig. 17. Sometimes they are of a deep purple colour, at other times of a brilliant red or dark brown, depending upon the nature of the food taken.

The ventral apertures, which are two in number, and circular, are very evident in each of the *Planariæ* above described, but more particularly so in the *P. torva* (fig. 6); the upper orifice gives passage to a long flexible tube, the lower one conducts to the ovarium. Of the use of this tube, which the *Planariæ* frequently project, and which nearly equals the body in length, I remained for some time ignorant, when it was discovered to me by mere accident.

Being desirous of ascertaining the proper food of these animals, as they were languishing in confinement, I threw in among them a variety of aquatic insects, worms, &c. One of them (*P. cornuta*), after the lapse of a few minutes fastened upon a worm, immediately projecting and affixing this tube: the worm being in this way closely retained, other *Planariæ* came forward to its assistance, and thus completely overpowered it. It is astonishing with what obstinacy they maintained their hold, notwithstanding the writhings and contortions of the worm to effect its escape.

The *Planariæ* seldom attack the worm openly, seemingly aware of the difficulty of thus overcoming it, but seize upon

it, as it were, by stealth, gliding gently underneath it, and then projecting and affixing this organ, keeping a firm hold until they have concluded their repast. I have seen, at times, nearly a dozen preying upon a solitary worm. *Fig. 16* represents the *P. cornutæ* thus engaged; at *a* and *b* this tube is seen projected. What however surprised me, was, to observe these animals, for a considerable time after, moving the head freely from side to side, still keeping the tube firmly affixed. As the worm was yet living, I imagined the sole use of this organ to be, that of effectually securing their prey. To be convinced of this, I gave them a dead worm, which they fastened upon in like manner: the head or mouth of these animals remaining, as in the former instances, unattached. This singularity could not fail of interesting me, since it appeared they received their food by this organ, and not by the mouth.

To remove any doubt which might still exist, I cut off the head of one of the *P. lacteæ*, and to the headless body presented, a day or two after, an earth-worm, upon which it soon affixed, and then inserted this tube; procuring in this way an abundant supply, sufficiently evidenced by the *interanea*, which were not before visible to the naked eye, becoming immediately conspicuous. Another *P. lactea* attached itself also to a portion of a large earth-worm, keeping its head the whole time detached, as delineated in *Fig. 15*. Here, also, the *interanea* were filled, affording an indisputable proof of nourishment having been taken in by this organ alone.

From a number of other experiments I found, that when the *Planariæ* were perfect animals, this organ was, while taking their food, in constant use; but in the event of their

being naturally or artificially divided, to which we shall soon advert, or their losing this tube, which was not unfrequently the case, they took their usual sustenance by the mouth.

I should not have entered into this detail, were I not apprehensive that I should be considered as labouring under some mistake, since it seems so contrary to the generally established law of nature, that an animal, furnished with a proper mouth, should receive its food by another organ, and that organ placed as near to the tail as to the head. Such, however, is the case; and the proofs advanced, will, I trust, be sufficiently convincing. In addition, I have to observe, that MÜLLER, after alluding to this organ, in his description of the *P. lactea*, says, "*Organum hoc nutrimento capiendo inservire vix dubitari potest.*"

Although I have repeatedly seen the young of the *P. torva* and *P. cornuta*, I have not yet been able to determine whether they are oviparous or viviparous, which I conceive to have arisen from having begun my enquiries late in the season. With respect to the *P. lactea* and *P. brunnea*, they are oviparous, producing eggs, within a membranous capsule, each capsule containing (at least those of the *P. lactea*), from 3 to 8 young.

One of the *P. lactea* deposited a capsule, July 8, which, on the 10th of August (33 days), produced 8 young.

Considering the size of the *P. lactea*, the capsule is of great magnitude, occupying nearly one-fourth of the body, forming a remarkable protuberance on the back. (fig. 5).

Six capsules were deposited by the *P. brunnea*, August 12, but of a size much less than those of the *P. lactea*; one only was productive (September 5th); it contained 2 young.

From a neighbouring pond I collected several capsules of this species, which I found attached to the under surface of the leaves of the *ranunculus aquatilis*, and found them to produce as follows :

July 26, 16 young from 5 capsules.

August 3, 25 ————— 7 ———

———— 12, 10 ————— 3 ———

making an average of three young to each capsule.

The young, on their immediate exclusion from the egg, are of different sizes, and remarkably active. I have sometimes seen them after taking food, so stretched, as nearly to double their previous size, a convincing proof of the great extent of the abdominal cavity.

A very singular part of the history of these animals, and what does not appear yet to have been noticed, is, that they have a double mode of perpetuating their species ; 1st. by capsules, which, as we have seen, contain several young ; 2ndly, by a *natural* division of the body into two portions, the head part reproducing a tail, and the tail a head, in about fourteen or more days, depending upon the state of the atmosphere.

Fig. 7 and *8* represent the *Planariæ* when about to divide to form two distinct animals. On the third day the separation of the head from the tail usually takes place, as at *fig. 9*. When undergoing this division, they remain for the most part stationary, keeping the head firmly affixed, twisting round the tail, from time to time, with a view of lessening its adhesion, and thus more readily effecting its disunion. Almost immediately after the head is liberated, it is seen to move with all the freedom of the unmutilated, perfect animal. The

tail generally remains attached, and only occasionally shifts its situation ; but if touched, it moves with nearly the same quickness as the anterior extremity, preserving an uniform gliding motion.

This property, which is common to the several *Planariæ* enumerated in this paper, is most strongly marked in the *P. cornuta*.

The reproductive power of these animals, when divided, is alluded to by MÜLLER, SHAW, and others. Indeed it could scarcely be expected, after the public attention had been excited by the astonishing reproduction of the *Polype*, even when cut or divided into several minute pieces, that the reproduction of an animal, so open to common observation as the *Planaria*, should long have remained unnoticed.

The following experiments show to what a degree this reproductive power extends.

July 8. I divided several of the *Planariæ* into two equal parts : the head and tail portions of the *P. torva* were reproduced in 14 days ; those of the *P. cornuta* in 17 days ; of the *P. brunnea* in 15 days ; and of the *P. lactea* in 19 days.

July 30. An equal number of the *P. cornutæ* and *P. lacteæ* were divided, transversely, a little below the eyes. The heads of the former were renewed in 11 days, of the latter in 14 days. The head portions were a long time in recovering the tail : in 16 days they were as delineated in *fig. 10* and *11*. As the *P. lactea* had recently taken food, the *interanea* are also exhibited.

August 9. The *Planariæ* were now divided into three equal parts : the middle portions were observed to reproduce heads and tails by the 25th (16 days). *Fig. 12* represents, under

a magnified form, the *P. brunnea*, and *fig. 13*, the *P. cornuta*, with renewed heads and tails. The head portions show, very distinctly, a circular-like range of black dots close to the margin, which I conjecture to be the eyes; and the tail portions show the renewal of the abdominal tube.

July 30. The *Planariæ* with newly formed heads, mentioned in the first experiment, were again divided, and reproduced by August 25 (26 days). At the time of the former experiment these animals were strong and vigorous, which sufficiently accounts for the difference of time in the reproduction. *Fig. 14* represents the head of one (*P. torva*) highly magnified, showing the eyes in the centre of the white areola.

I afterwards divided these animals into four, five, and even six parts; and what was extremely singular, each part seemed to possess the properties of a perfect animal, moving about in the water in the same gliding manner as before the separation. But when thus divided, they seldom retained their vitality beyond a few days, or if any portion did, perchance, recover its lost parts, it was a process extremely slow and tedious.

To render these experiments successful, it will be necessary to divide the *Planariæ* immediately on their being taken from their native haunts, for, when long confined, they lose their activity, and are ill calculated for the purpose. I should have observed, that, although the lost parts are generally reproduced in about a fortnight, yet a month or more is required before they take on the precise form and colour of the original animal.

The *Planariæ* with renewed organs were placed in a vessel

by themselves, and two or three, notwithstanding their previous artificial division, divided naturally, as at *fig. 9*.

Having frequently noticed several full-grown *Planariæ* with the head and tail of a greyish white, the rest of the body being brown or black, I should, without the knowledge of this re-productive property, have been led to consider them a distinct species.

In reference to the *P. lactea*, MÜLLER says; “ *Unicum exemplar cujus cauda in duos lobos acutos fissa erat reperi, aliud absque oculis, et interaneis conspicuis, mere lacteum; cæterum idem.*” It seems he was not aware, or I think he would have noticed it, that the circumstance of these *Planariæ* being without eyes, &c., was occasioned by their having undergone a natural division, in order to their becoming distinct and separate animals.

J. R. JOHNSON, M. D. F. R. S. and L. S.

Bristol,

September 24, 1821.

EXPLANATION OF PLATE XLIX.

Fig. 1. *P. cornuta*, front view, natural size.

2. *P. torva*, Do. Do.

3. *P. brunnea*, Do. Do.

4. *P. lactea*, Do. Do.

5. Do. with its egg or capsule.

6. Back view of *P. torva*, showing the ventral foramina.

7. *P. cornuta*, about to undergo a natural division.

8. *P. torva*, Do. Do.

Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.



Fig. 5.



Fig. 6.



Fig. 7.



Fig. 8.



Fig. 9.



Fig. 15.



Fig. 16.

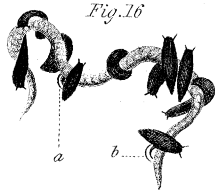


Fig. 14.



Fig. 10.



Fig. 11.



Fig. 17.



Fig. 13.



Fig. 12.



9. Head and tail of *P. cornuta*, naturally divided.
10. Head of *P. cornuta*, with tail partly renewed.
11. Head of *P. lactea*, Do. Do.
12. *P. brunnea*, with renewed head and tail.
13. *P. cornuta*, Do. Do.
14. Head of *P. torva*, highly magnified, showing the eyes in the centre of the white areola.
15. *P. lactea* attached to a portion of a large earth-worm, with the abdominal tube inserted.
16. *P. cornutæ* preying upon an aquatic worm, showing at *a* and *b* the abdominal tube.
17. *Interanea* of *P. lacteæ*, highly magnified, showing its arborescent ramifications.